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Research Article

Susceptibility Studies on Two Varieties of Tomato (*Lycopersicon esculentum*) to Fungal Leaf Spots

Ibrahim, H[1]., Dangora, D. B [2]

[1]Department of Biological Sciences, Kaduna State University, Kaduna
[2]Department of Botany, Ahmadu Bello University, Zaria

*Corresponding Author
Ibrahim, H.

Abstract: Tomato (*Lycopersicon esculentum*), family; Solanaceae is a major crop of world commerce and supplies essential nutrients in human diets. Eight different fungal isolates (*Fusarium equisetum*, *Alternaria* sp., *Cladosporium* sp., *Septoria* sp., *Nigrospora aerophila*, *Macrophomina* sp., *Macrophoma* sp. and *Choanephora* sp.) were inoculated on two varieties of tomato (tian shan miao 99-1 and tian shan miao 87-5) to determine their susceptibility to the leaf spot fungi. The eight fungal isolate inoculated on the two varieties of tomato leaves shows different types of symptoms, the disease incidence and severity were found to be higher on the variety tian shan miao 87-5 than tian shan miao 99-1. Also as the disease incidence increases so do the disease severity increases. Out of the eight fungi inoculated on the tomato leaves *Fusarium equisetum*, *Alternaria* sp., *Cladosporium* sp. and *Septoria* sp. have the highest diseases severity and diseases incidence followed by *Nigrospora aerophila* while *Macrophomina* sp., *Macrophoma* sp. and *Choanephora* sp. have the least.

Keywords: *Lycopersicon esculentum*, Fungi and Leaf Spot.

INTRODUCTION

Tomato (*Lycopersicon esculentum*), family; Solanaceae is a major crop of world commerce and supplies essential nutrients in human diets. Tomatoes are native to South and Central American and are now cultivated widely throughout the world. They are one of the most widely cultivated vegetable crops in Africa (David, 2007).

Many diseases and disorders can affect tomato during growing season (Gleason and Edmunds, 2006). Several fungal, bacterial and some viral diseases of tomato contribute to severe yield loss of tomato under field condition (Akram *et al.*, 2014). Some pathogens causing leaf spot diseases infect fruit as well other plant parts which indirectly affect yield by causing defoliation, which exposes fruit to sunburn reducing fruit quality (including taste) and reducing fruit production (Mc Grath, 2015). *Septoria lycopersici*, *Alternaria solani*, *Phytopthora infestans* are fungi reported to cause leaf spot (Gleason and Edmunds, 2006).

Septoria leaf spot is probably the most common foliar diseases of field grown tomatoes causing yield loss of up to 100% (Mc Grath, 2015; RPD, 1999). *Cladosporium* leaf mold is a disease of tomato which primarily is a problem on greenhouse grown tomatoes but can occur in the field when humidity is high (Schwartz and Gent, 2007).

The aim of this study is to determine the susceptibility of two tomato varieties to fungi causing leaf spot in Zaria area. This will add to the knowledge and diversity of fungi causing leaf spot diseases of tomato in this area.

MATERIALS AND METHODS

The two tomato varieties (tian shan miao 99-1 and tian shan miao 87-5) were collected from department of Agronomy Institute of Agricultural Research, Ahmadu Bello University, Zaria. Eight different fungal isolates (*Fusarium equisetum*, *Nigrospora aerophila*, *Alternaria*, *Cladosporium*, *Septoria*, *Macrophomina*, *Macrophoma* and *Choanephora* spp.) were collected from the Department

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of Crop protection faculty of Agricultural sciences, Ahmadu Bello University, Zaria.

Isolates were sub cultured onto Potato Dextrose Agar (PDA), once sporulating abundantly, they were flooded with sterilize distilled water, macerated in a blender and the suspension pass through four- folded layers of cheese cloth inside a funnel, to obtain a conidial suspension , concentration was standardized to the appropriate conidia/ml using a haemocytometer for each fungus.

In the green house, treatments consisting of the two varieties of tomato. Tomato seeds were sown in sterilized soil in rubber container and transplanted two weeks after germination on sterilized soil in 18cm (diameter) Perforated black polyethene bag two plant per leather bag; four leathers per isolate, making eight plants for each variety per isolate. The tomato plants were inoculated one week after transplanting with the appropriate conidial suspension of the different isolates. Shortly after inoculation, all seedlings were placed for 48hours under an enclosure made of a white polyethylene sheet to encourage humidity. The plants were observed daily for disease development. The following data were collected;

1. Presence and type of symptoms on the various plant parts.
2. Disease incidences= $\frac{\text{Number of plants with symptoms}}{\text{Total number of plants}} \times 100$ (Marley, 2013)
3. Disease severity on the affected plant.

To obtain disease severity, symptoms were measured using the rating scale of 1-5 modified from (Nakawuka and Adipala, 1997; Owolade *et al*, 2006), namely:

1= no symptoms.
2= Up to 20% (Scattered lesion on either foliage).
3= 21 to 40% (Extensive spotting of foliage and young stem).
4 = 41 to 60% (leaves lesions coalescing, covering half the foliage).
5= 61 to 80% or more (Foliage severely damaged, plant without fruits).

The inoculated leaves were collected and the fungi isolated through the tissue plating methods on Potato Dextrose Agar (PDA). Lesions were cut off from infected plants with sterile surgical blades. All lesions were surface sterilized in 0.1% mercury chloride (HgCl) for three minutes and rinsed three times with sterile distilled water. Lesions were plated on Petri dishes (four lesions per plate) containing PDA amended with streptomycin sulphate (1.5g/l) to inhibit bacterial growth. Each sample was in duplicate .The Petri dishes were incubated at room temperature. Observation was made daily for seven days, for the presence of colonies of fungal pathogen. The fungi colonies were sub cultured on fresh PDA for subsequent identification (Mungo, 1996).

RESULTS

Results of inoculation of two varieties of tomato with the fungal isolates shows that *Fusarium equiseti* produces spot with white center dark brown margin with tian shan miao (87-5) having numerous spots than tian shan miao (99-1) as shown in plate 1 and table 1. *Alternaria* sp. produces spots having white center with dark brown margin on the two varieties of tomato as shown in plate 2 and table 1. *Cladosporium* sp. produces brown circular spots as shown in plate 3 and table 1. *Septoria* sp. produces brown spots with small white centers as shown in plate 4 and table 1. *Nigrospora aerophila* produces circular brown lesions as shown in plate 5 and table 1. Also *Macrophomina* sp. produces coalesced brown lesions as shown in plate 6 and table 1. *Macrophoma* sp. leads to brown lesions that makes hole when older as shown in plate 7 and table 1. *Choanephora* sp. produces spot with white center and light brown margin as shown in plate 8 and table 1.

Disease incidence showed that tian shan miao (87-5) have the highest disease incidence with up to 100% for *F. equiseti*, *Alternaria*, *Cladosporium* and *Septoria* spp. *N. aerophila*, *Macrophomina*, *Macrophoma* and *Choanephora* spp. have 50% disease incidence while on tian shan miao (99-1) have the least disease incidence of *F. equiseti* (50%), *Alternaria*, *Cladosporium*, and *Septoria* spp (75%), *N. aerophila*, *Macrophomina*, *Macrophoma* and *Choanephora* spp (25%) as shown in figure 1.

Disease severity shows Tian Shan Miao (87-5) has the highest disease severity with *F. equiseti*, *Alternaria*, *Cladosporium* and *Septoria* having 4 while tian shan miao (99-1) has 2 and 4. *N. aerophila* has 3 on Tian Shan Miao (87-5) while on (99-1) have 2. *Macrophomina*, *Macrophoma* and *Choanephora* spp. have 2 on both tian shan miao (87-5) and (99-1) as shown in figure 2.

Table 1: Symptoms Produced by Fungal Isolates on two Varieties of Tomato

Fungi	Tian shan miao (99-1)	Tian shan miao (87-5)
Fusarium equisetum	Few spot with white center dark brown margins	Numerous spot with white center dark brown margins
Alternaria sp.	White center dark brown margin	White center dark brown margin
Cladosporium sp.	Few Brown circular spots with grey center	Numerous Brown circular spots
Septoria sp.	Brown lesions with small white centers	Brown lesions with small white centers
Nigrospora aerophila *Macrophomina* sp.	Circular brown lesions Brown lesions coalescing	Circular brown lesions Brown lesions coalescing
Macrophoma sp.	Brown lesions making hole	Brown lesions making holes
Choanephora sp.	White center with light brown margin	White center with light brown margin

Plate 1: Tomato plant inoculated with *Fusarium equisetum*

Plate 2: Tomato plant inoculated with *Alternaria sp*

Plate 3: Tomato leaf inoculated with *Cladosporium sp*

Plate 4: Tomato plant inoculated with *Septoria* sp

Plate 5: Tomato plant inoculated with *Nigrospora aerophil* sp

Plate 6: Tomato plant inoculated with *Macrophomina*

Plate 7: Tomato plant inoculated with *Macrophoma* sp.

Plate 8: Tomato plant inoculated with *Choanephora* sp

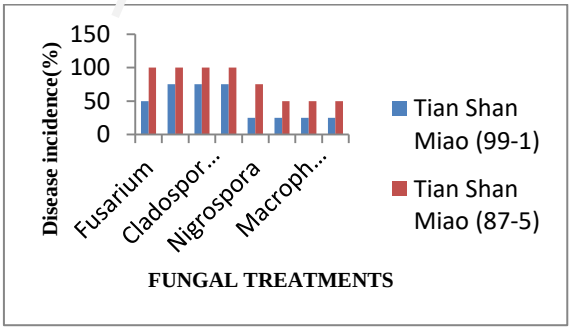

Figure 1: Diseases incidence on two varieties of Tomato

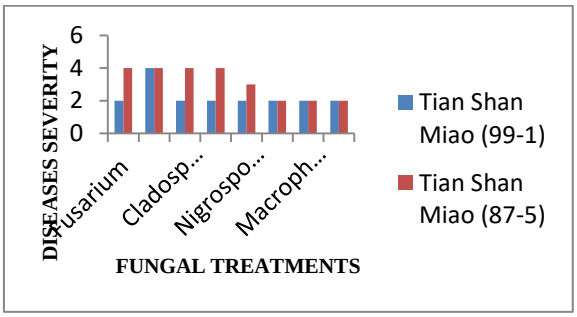

Figure 2: Disease Severity on two Varieties of Tomato

DISCUSSION

In this study Eight fungal isolate inoculated on two varieties tomato plants which shows different types of symptoms, the disease incidence and severity found to be higher on the variety tian shan miao 87-5 than tian shan miao 99-1. Also as the disease incidence increases so do the disease severity increases. *Cladosporium, Alternaria* and *Septoria* spp. and *Fusarium equisetum* have the highest disease incidence and diseases severity, followed by *Nigrospora aerophila, Macrophomina, Macrophoma* and *Choanephora* spp. have the least disease incidence and severity. *Cladosporium, Alternaria* and *Septoria* spp. have been reported as major fungal pathogens causing leaf spot diseases of tomato plant (Emechebe *et al.,* 1980; McGranth, 2015; RPD, 1999). *Fusarium equisetum* has been reported to cause leaf spot on groundnut (Marley, 2013). Emechebe *et al*., 1980 reported *Alternaria* spp., *Cladosporium fulvum*, and *Septoria* sp to cause leaf spot on tomato in savanna and semi-arid regions in Nigeria, also *Nigrospora* sp. and *Fusarium* sp. have been isolated from leaf spot on *Capsicum annum* (pepper) from the same region. *Septoria* spp. has been reported to cause leaf spot on different plants species (Mc mullen, 2009; Ojiambo *et al.,* 2007; Singh and Allen, 1979). Other species of *Nigrospora* had been reported to cause leaf spot on many other cultivated and wild plants (Nutsugah *et al.,* 2004; Verma and Gupta, 2008; Zheng *et al.,* 2012). *Macrophomina, Macrophoma, Choanephora* spp. have not been reported to be associated with spot diseases making this the first report.

CONCLUSION

From the studies above it has been concluded that the two varieties of tomato are susceptible to leaf spot caused by *Fusarium equisetum, Nigrospora aerophila, Alternaria, Cladosporium, Septoria, Macrophomina, Macrophoma* and *Choanephora* spp.*).* However the variety tian shan miao 87-5 is more susceptible to fungal leaf spot diseases than tian shan miao 99-1.

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